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Marine Corps Communication-Electronic Maintenance: A Broken System

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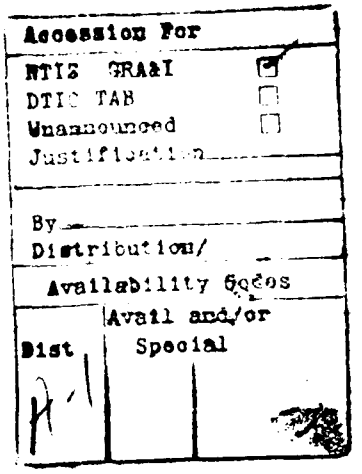

Thesis: The United States Marine Corps maintenance system is effective; however, measures can be taken to strengthen the system. This paper covers the foundations of communications-electronics maintenance, personnel and training issues, and equipment acquisition problems.

USMC; Command and Control; C2; C3; C4I; Joint Command and Control; C-E Maintenance; MCLLS; Maintenance Management; Acquisition; Education

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MARINE CORPS COMMUNICATION-ELECTRONIC MAINTENANCE: A BROKEN SYSTEM?

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MARINE CORPS COMMUNICATION-ELECTRONIC MAINTENANCE:

A BROKEN SYSTEM?

OUTLINE

THESIS: The Marine Corps maintenance system is effective; however, measures can be taken to strengthen the system.

I. Introduction

II. Foundations of Communication-Electronic Maintenance

III. Personnel and Training

- A. Strength of Component Level Troubleshooting Skills
- B. Effects of Down-Sizing On Maintenance Personnel
- C. Lack of SNCO and Warrant Officer Follow-On Training
- D. Need For Microcomputer Repairers at All Levels
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- A. Examples of Acquisition Shortfalls
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V. Peacetime to Wartime Transition of Maintenance Procedures

- A. The Maintenance Forward Concept
- B. Use of Maintenance Contact Teams
- C. Automated Information System Support
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- F. Correcting Transition Problems

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Appendix 1 - SAMPLE QUESTIONNAIRE

MARINE CORPS COMMUNICATION-ELECTRONIC MAINTENANCE: A BROKEN SYSTEM?

> The phrase shoot, move, and communicate is widely used throughout the Marine Corps. It tells the commander, in simple language, what actions are essential to mission accomplishment. A fourth word should be added to this phrase - maintain. (2:1-1)

If equipment is not maintained in combat-ready condition, the commander will face far greater challenges in accomplishing the mission at hand.

One of the greatest challenges to the Marine Corps' command and control capability is the ability to maintain equipment in a combat environment. As increasingly advanced technology is provided by civilian industry, the maintenance effort becomes more complex. The Marine Corps must meet this maintenance challenge by ensuring that its maintenance program is virtually flawless. As FMFM 3-1 states:

> The force better able to recover damaged equipment and return it to service rapidly has a clear advantage in generating and concentrating combat power. For the force operating at a numerical disadvantage, the ability to maintain, recover, and repair equipment is even more important.

FOUNDATIONS OF COMMUNICATION-ELECTRONIC MAINTENANCE

A strong maintenance system requires superior personnel training, carefully planned acquisition policies,

adequate supply support, and sound procedures to transition from peace to war. The Marine Corps maintenance system is not broken, but numerous measures could be taken to better the system. This paper identifies existing shortfalls in the maintenance system and offers recommendations to strengthen the system. Sound maintenance procedures must be incorporated with stringent training, and maintenance concerns must be integrated into the acquisition process to ensure that our maintenance system remains *not broken*. As a result of our research, we see the foundations of the communication-electronic maintenance system to be training, acquisition, and transition to war. Each foundation contributes equally to the success of the overall system, as depicted in Figure 1.

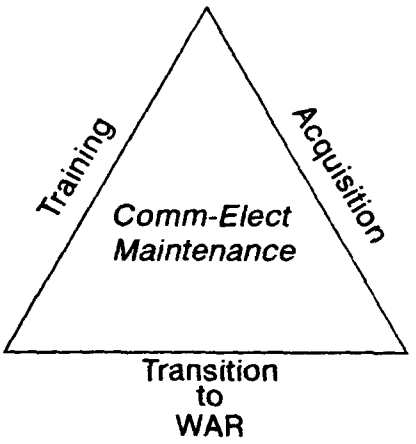


Figure 1: Foundations of the Communication-Electronic Maintenance System

PERSONNEL AND TRAINING

Training builds the first leg of the communication-electronic triangle. Training must produce a well-coordinated, combat-ready unit prepared to perform its function in a wartime environment. Because today's sophisticated systems must be maintained in a high state of readiness, qualified personnel must be available at all levels.

The Marine Corps expends considerable time and funding to provide qualified maintenance personnel to all levels within the Fleet Marine Force (FMF). Throughout our research, formal communication-electronic maintenance training was continually referred to as *exceptional*. (12) An experienced maintenance officer stated that entry level repairers in the Marine Corps may be equated with more experienced technicians in other services; technicians in the Marine Corps have the equivalent of a two-year associate's degree. (17) The level of training provided to communication-electronic maintenance personnel is indeed a tremendous strength of the overall maintenance system. All Marines entering the 2800 occupational field first attend the Marine Corps Communication-Electronic School's (MCCES) Basic Electronic Course (BEC) for thirteen weeks. Next they attend a Military Occupational Specialty (MOS) specific course or school offered by the Marine Corps or

other services. The Marine Corps strives to produce 2800s with superior technical abilities. Technical training has been structured to produce repairers and technicians who can maintain and repair, to the component level, all communication-electronic equipment as far forward as possible on the battlefield. This is particularly true for MOS 2841 Ground Radio Repairer, 2831 Microwave Equipment Repairer, and 2861 Radio Technician. These MOSs are used as feeder MOSs for other critical low density (CLD) repair MOSs such as 2834 Ground Mobile Forces (GMF) Satellite Communication (SATCOM) Technician and 2833 Fleet Satellite Terminal Technician. (3:P18)

STRENGTH OF COMPONENT LEVEL TROUBLESHOOTING

Experiences during Operations Desert Shield and Desert Storm revealed significant issues that will influence future decisions on training provided to 2800s. Despite delays in receiving repair parts from the Continental United States (CONUS), Marine Corps units were able to maintain up to ninety percent readiness for communication equipment. This success has been attributed to the level of training the Marine 2800 repairer has received, both in school and from on-the-job training (OJT). (3:P18) In a few instances, Marine Corps maintenance units were asked to perform component level repairs on Army equipment. This

Consequently, when

assistance was possible because of the troubleshooting skills the Marine repairers possessed. Because of transportation delays, the small number of secondary repairables normally in the CLD maintenance float, the high use of equipment in a harsh desert environment, and little to no contractor maintenance support, the capability to conduct component level troubleshooting remained critical. (3:P18)

If the Marine Corps adopts the operator-maintainer concept which is currently used by the Army, the need remains for highly trained repairers at deployable intermediate level maintenance activities such as Electronic Maintenance Company (ELMACO), Force Service Support Group (FSSG). Without repairers trained to troubleshoot to the component level, equipment repairs would have to be performed at the depot level (Albany, Georgia or Barstow, California) or through contractor maintenance agreements. Neither approach facilitates performing maintenance as far forward on the battlefield as possible. The Marine Corps must continue its present system of training to produce fully qualified repairers and technicians to all levels within the FMF. (17)

EFFECTS OF DOWN-SIZING

The down-sizing of the Marine Corps will affect

maintenance personnel. As end strengths dwindle, the number of Marines in the FMF will decrease. Tables of Organization (T/Os) are being cut to accommodate manpower reductions. However, no missions have been deleted and equipment strengths have not dropped; in many cases, equipment quantities have actually increased. Yet, the number of 2800s continues to drop. (4:L11) To reduce the number of 2800s, reenlistments are being cut or eliminated entirely for certain MOSs. (23) This reduction of 2800s will force Marines to leave the service or to move to maintenance MOSs which are understaffed. The result is dramatic. The Marine Corps is in a lose-lose situation. On one hand, if a technician cannot reenlist and leaves the service, a tremendous investment of training and experience is lost. On the other hand, if a Marine makes a lateral move into another MOS, the Marine Corps will have Marines supervising MOSs in which they have no qualifications or experience. (23)

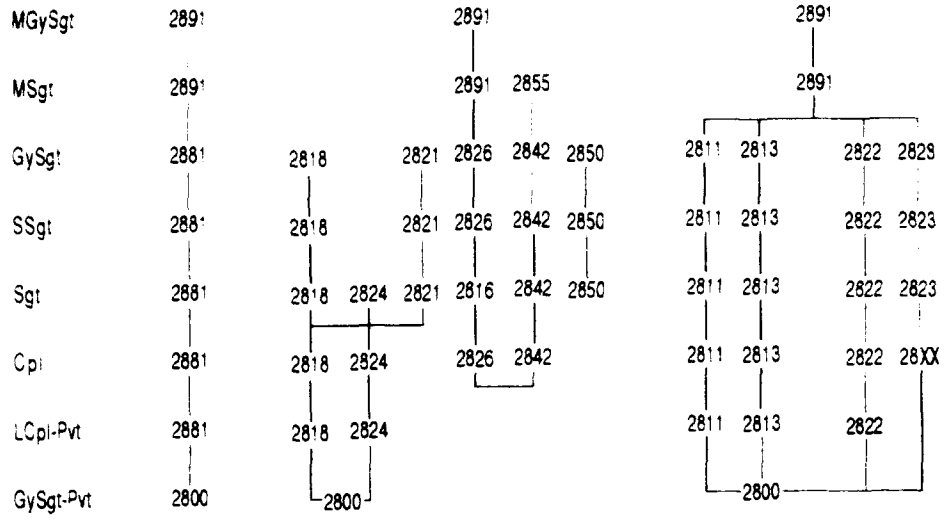
Extending the enlistment term for the 2800 community from four years to six years would maximize the investment dollars it takes to train a repairer. It normally takes one and half years for a Marine to complete recruit training and the basic electronics training leading to a 2800 MOS. This leaves approximately two and a half years to serve in the FMF and work in the MOS. For a six year

enlistment, the service time in the FMF would increase to four years. It has been argued that by the time a technician becomes proficient, the enlistment contract is ending. (31)

SNCO AND WARRANT OFFICER FOLLOW-ON TRAINING

Another concern for maintenance personnel is the lack of training provided to senior Staff Non-Commissioned Officers (SNCOs) and warrant officers. A 2800 Marine becomes a 2891 Data Communications Maintenance Chief once promoted to master sergeant. The Marine has only to have been qualified in any 2800 MOS as a gunnery sergeant. (11:3-122) Figure 2 illustrates the various paths that lead to the 2891 MOS. With the wide variety of MOSs that can become 2891s comes a wide variety of experience, or in many cases, a lack of necessary experience. (28)

Currently, no formal training program is established to transition 2800s into the senior enlisted maintenance MOS. (4:P4) Some Marines find that, once promoted to master sergeant, they cannot optimally perform because they do not possess the experience or technical skills necessary to perform as a 2891. Similarly, Marines from the Technical Controller 2823 MOS have been working so long as technical controllers between the ranks of sergeant through gunnery sergeant, that they have lost their ability to



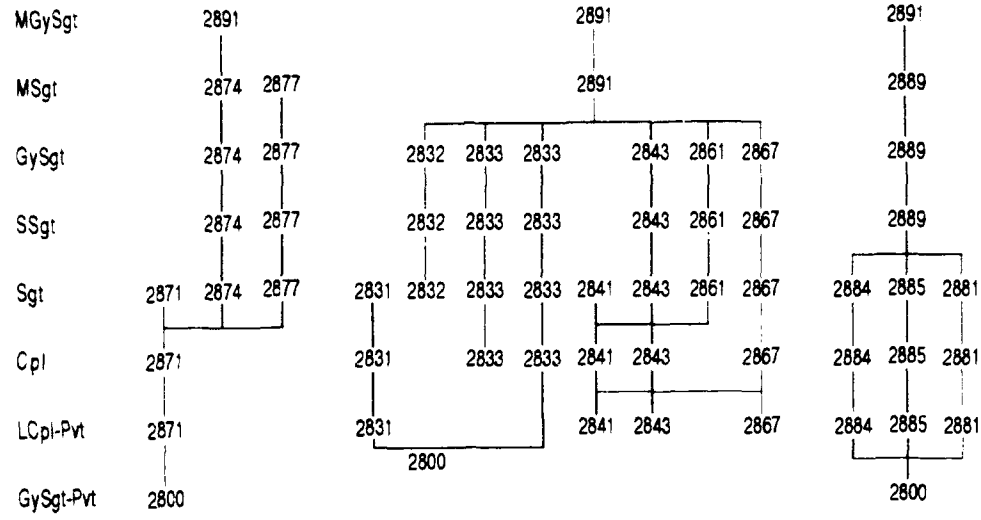


Figure 2: 2891 MOS Career Progression

perform as technicians. In the dynamic environment of today's computer and communications equipment repair community, their expertise in these areas has declined dramatically. This is also true of those maintenance management functions to which these Marines had been formerly exposed. (4:L17)

There is similar concern for new warrant officers. Newly appointed warrant officers are sent to the Basic Communication Officer's Course (BCOC). Our research indicates that this does not adequately prepare warrant officers to serve as maintenance officers. (4:P4) An Electronics Maintenance Supervisor's Course is being developed at MCCES, Twenty-Nine Palms. It is estimated that this course will be on line for future graduating classes from the warrant officer's course at The Basic School. Headquarters Marine Corps has given tentative approval to send 2805s and 2810s to this course in place of the BCOC they are now attending. However, the possibility of sending newly appointed 2891 master sergeants remains uncertain due to limited funding. (3:1)

MICROCOMPUTER REPAIR

Over the past few years, the Marine Corps has purchased a wide variety of off-the-shelf white computers, to include Zeniths and Compaqs. Repair of these computers

has been limited to using civilian contractor support and floating selected components through the maintenance float. (4:P11) As maintenance personnel learned from Operation Desert Storm, civilian contractor support is untimely and unacceptable during war. Computer repair technicians are trained primarily on the AN/UYK-83s and the AN/UYK-85s. There are few of these technicians in the field units and their expertise on commercially acquired microcomputers is limited. (4:P11) Currently, over half of the units within the Marine Division possess no organizational computer maintenance capability. Computer maintainers are omitted from the T/Os of the Headquarters Infantry Regiment, Artillery Battalion, and Assault Amphibian Battalion, among others. (4:L12) The dependence upon microcomputers has created a tremendous need for organic computer maintenance personnel in each regiment and separate battalion.

Additionally, no repair capability exists at the Communication Battalion to provide organizational or intermediate level maintenance on computer equipment. (6) The problem rests with the structure of the 2818 Teletype Technician MOS. Many computers in every unit require periodic repair, yet the current assignment of the 2818 MOS among units does not support their repair. (27) Assignment of Marines to MOS 2818 is based on the former capability they provided as teletype repairers. Since the MOS is now

primarily concerned with microcomputer repair, we must reevaluate the assignment of these maintenance personnel. The assignment of microcomputer repairers must facilitate the performance of repairs at the lowest echelon of maintenance and, in a tactical environment, as far forward as possible. Their assignment must also reflect the new MOS 2818 capability for microcomputer repair vice the old capability for only teletype repair. Of twenty-three major subordinate elements (MSEs) in the Marine Division, only twelve have microcomputer repairers. All twenty-three have End User Computer Equipment (EUCE) AN/UYK-83s and AN/UYK-85s as well as many commercial computers, each requiring regular maintenance. (27)

In the past, the assignment of 2818s corresponded with the density of teletype equipment in each unit. As the teletype has largely been replaced by the microcomputer, the MOS training for 2818s has changed accordingly, but 2818 assignment within the Marine Division has not changed. Further, the number of 2818s in each unit in no way corresponds to the density of computer equipment. (27) The Marine Corps needs a restructuring plan that would place at least one 2818 in each MSE, thus providing each MSE with organic microcomputer repair capability.

This problem can be solved despite force reductions. One such solution reduces the manning level at the infantry

battalion from two 2818s to one and redistributes the extras to other division units. It eliminates the 2889 radar repairman from the infantry regiment to compensate for any additional 2818s that are required. (4:L12) Currently, the infantry regiment holds no table of equipment items which the 2889 is trained to repair. In addition, all 2818s, 2821s, and 2824s must be trained to repair commercially procured computers. This training must be planned for and incorporated into a well designed maintenance support concept to meet future challenges in a combat environment where civilian contractor support will not be available.

NONRESIDENT EDUCATION

Another important aid in the training effort is the use of Marine Corps Institute (MCI) courses. MCI provides nonresident specialized skill training and professional military education. Currently only two correspondence courses are offered to the 2800 community. They are "Fundamentals of Digital Logic," developed for private first class (PFC) and lance corporal (LCPL), and "Introduction to Test Equipment," developed for use by those up to sergeant level who use diagnostic test equipment in the performance of their regular duties. (4:P15) These MCI courses are not sufficient for our

future needs in the maintenance support community. MCI must do for the maintenance community what it has done for other MOSs. At a minimum, MCI must develop data communication courses which are generic to the maintenance skills required to support the next generation of tactical communications equipment. Additional courses should be developed to fill the void in maintenance MOSs such as 2811 Telephone Technician, 2813 Cable System Technician, 2822 Unit Level Circuit Switch Technician, and 2823 Technical Controller, which have no formal follow-on training. With the proliferation of state-of-the-art communication equipment and the restrictive funding policy for training, alternative training methods must be used to the maximum extent.

STRENGTHENING THE TRAINING FOUNDATION

The Marine Corps has a sound maintenance training philosophy. It must continue to train Marines who can isolate system failures to the component level and replace these components as required. Reductions in personnel and funding are forcing reductions in training. Many of the individuals in charge of fiscal allocations are questioning large expenditures for technical training. The missing factor in the budget equation is: Can the Marine Corps perform its mission in the tactical environment with

reduced technical skills? Equipment is more sophisticated and requires advanced technical skills. Accordingly, occupational field sponsors and enlisted monitors must objectively view the situation with regard to promotions and reenlistments and make the necessary decisions based on what is best for the Marine Corps. The Marine Corps must extend initial enlistments, provide career level follow-on training, complete the curriculum for the Maintenance Supervisors Course at MCCES, ensure availability of microcomputer technicians, and establish additional MCI courses. These measures will solidify the training foundation and strengthen the first leg of the maintenance triangle.

EQUIPMENT ACQUISITION

The acquisition program, external to the Marine Corps' maintenance system, has a direct impact on maintenance support responsiveness. As a foundation of communication-electronic maintenance, the acquisition process forms the second leg of the maintenance triangle. This process concentrates on the procurement of high technology equipment for the Marine Corps to support command and control requirements and to plan for compatibility of equipment with the other services. The acquisition process does not, however, concentrate on research and development

of the maintenance concepts required to support a new system. Our research indicates that the supportability of new systems is not always considered as part of the whole systems package, but rather is considered only after equipment fielding. (23)

During procurement, supportability requirements of the systems must be developed. More often than not, new systems are fielded without a maintenance concept, which includes supporting technical manuals and publications, training plans for technicians, appropriate test equipment, and adequate Initial Issue Provisional (IIP) packages. These packages, which should contain the replacement parts for the components that are most likely to fail, are normally incomplete or contain components that are rarely used. Many new systems are fielded without a Marine Corps maintenance concept, and therefore we are dependent on civilian contractors to provide maintenance support. The inefficient acquisition process has hindered the effective maintenance operation of communication-electronic systems to include Unit Level Circuit Switch (ULCS), AN/PSC-3 satellite communication radio, Savin 7020S photo copy machines, and commercial off-the-shelf (COTS) systems.

EXAMPLES OF ACQUISITION SHORTFALLS

During initial fielding, the ULCS was designated as a

normal density item. After its employment in the FMF, the ULCS was designated as a CLD item. (4:P17) The supporting argument for this change was that operational scenarios dictate widely dispersed command posts which distance the switches from the float stores held by the FSSG. (4:P17) Because the ULCS is an essential element of a command, control and communication network, providing tactical voice switching, any down time is considered critical. When the ULCS became a CLD item, using units were required to maintain their own maintenance floats to support the equipment. The impact of the change was felt at the maintenance depot in Albany, Georgia, which had provisioned spare parts under the original designation of normal density. When the ULCS was redesignated, the required spare parts were not available in the quantities needed. This change from normal to critical low density, which was not originally expected during the acquisition process, will cost an estimated twelve million dollars.

The procurement of the AN/PSC-3 radio is another example of an acquisition shortfall. As a CLD item, the PSC-3 receives first through fourth echelon maintenance from the using unit. Test equipment, technical manuals and publications, a kit containing at least one of all modules, and an assortment of Pre-Expended Bin (PEB) parts are required to enable the unit to conduct fault isolation and

minor alignment. (4:P13) However, these items were not fielded with the PSC-3 radio. The using units were not able to maintain the equipment until these items were procured. The Single Channel Ground-Air Radio System (SINGARS) and Global Positioning System (GPS) systems shared the same problems when they were fielded.

The Savin 7020S photo-copying machines were purchased to replace commercial copiers in garrison and to support tactical operations. Maintenance of these copiers is a responsibility of the FSSG; however, the parts required for their repair are not in the Marine Corps' supply system. Repair floats do not exist for the copiers, so repair parts must be requisitioned from the Savin Corporation. Receipt of the requisitioned items often occurs thirty days after Savin has received the broken components; the result is maintenance delays. (3)

To procure advanced technology, the Marine Corps currently purchases many COTS systems from civilian industries. These systems are purchased before a Marine Corps maintenance concept is developed; therefore, they are added to the inventory before they are supportable. (23) For example, when the white computers were purchased, the manufacturers were contracted to provide garrison maintenance as part of the warranty. When these systems were deployed in Southwest Asia, no provisions had been

made for their maintenance in country. Consequently, when the computers required maintenance, no support was readily available. Technicians must be trained to support all COTS systems purchased for Marine Corps use. This training must be identified as part of the maintenance concept during the acquisition process.

RESTRUCTURING THE ACQUISITION PROCESS

Marine Corps Systems Command's (MARCORSYSCOM) Acquisition Branch must standardize equipment fielding procedures. Equipment that cannot be supported is of little value to using units. The Marine Corps must streamline the structure of acquisition commands and agencies to support the development of maintenance concepts.

Presently, two separate commands contribute to the acquisition process. MARCORSYSCOM, which contains the Acquisition Branch at Quantico, establishes procurement priorities and solicits to Headquarters Marine Corps for budgeting. The Marine Corps Tactical Systems Support Activity (MCTSSA), located at Camp Pendleton, but also part of MARCORSYSCOM, provides testing and documenting functions. The Marine Corps Operational Testing and Evaluation Activity (MCOTEA), a separate command at Quantico, functions as an independent testing agency.

Consolidating the functions of MARCORSYSCOM and MCOTEA will allow for a cohesive, effective acquisition structure that eliminates testing redundancy and complements the acquisition process. (19)

To effectively restructure the Acquisition Branch of MARCORSYSCOM, the project manager billets for communication-electronic systems must be assigned to communication- electronic officers. Subordinate to the project manager will be an Electronic Maintenance Officer (MOS 2802, 2805, or 2810), a representative from MCTSSA, and a representative from MCOTEA. (19) The structure we propose is depicted in Figure 3. If acquisition functions are delegated to these subordinates, the current burdens on the project manager will decrease. Fielding the systems will no longer be the sole responsibility of the project manager; each subordinate will be responsible for specific functions of the acquisition process.

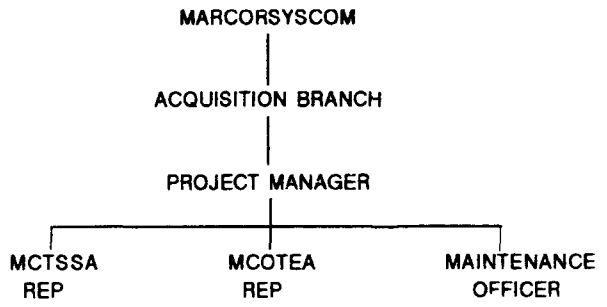


Figure 3: Proposed Acquisition Structure

The project manager's responsibilities will include prioritizing communication-electronics requirements. With input from the FMF, the project manager will continue to procure systems that satisfy Marine Corps requirements, and ensure that these systems are interoperable with other services' systems. The project manager will focus on developing budgets for systems and getting the budgets approved by Headquarters Marine Corps. (19) The project manager will also contract for civilian systems, and distribute allotted funds for initial purchase, technical training, and maintenance requirements of the systems.

The maintenance officer will advise the project manager on maintenance related issues. The maintenance officer's knowledge, acquired through first hand fleet experience, will provide the maintenance expertise required to field complete systems.

The maintenance officer's primary responsibility will be to ensure maintenance concepts are established for each procured system. Effective maintenance concepts will consist of thorough maintenance packages. These packages will include all of the supporting technical publications and manuals, the required test equipment to perform fault isolation and subsequent repair, and complete repair kits which contain the requisite number of replacement components.

Prior to procuring a new system, the MCOTEA representative will determine the Mean Time Between Failure (MTBF) of all components of the system and ensure that adequate quantities of spares are purchased to meet the MTBF rate. Civilian contractors will identify failing components; the MCOTEA representative will ensure that thorough field testing in the fleet is accomplished. This process will not only identify fault sensitive components, but will also ensure the equipment can withstand a rugged field environment and satisfy Marine Corps communication-electronic requirements.

The MCTSSA representative will review the technical manuals and publications developed by the civilian contractors to ensure that they are accurate and readable. Technical publications are vital to any maintenance effort; this step of the acquisition process is critical.

Close coordination between the maintenance officer, MCOTEA representative, and MCTSSA representative is crucial to the acquisition process. This team must integrate the testing results, the accuracy of technical manuals, and maintenance requirements to produce a <u>complete</u> maintenance package. The project manager must monitor the process closely to ensure adherence to any budget constraints. No system will be acquisitioned before maintenance concepts are established, and budgeting constraints must be

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identified and planned for to ensure complete systems are fielded.

Restructuring the Acquisition Branch is a feasible and effective method to increase the supportability of new systems. What is the bottom line? The Marine Corps must incorporate a maintenance concept into the acquisition process to allow timely and effective maintenance of command and control systems. The current acquisition process does produce systems which allow our forces to "shoot, move, and communicate," but it does not produce the means to accomplish the "fourth [function which] should be added to this phrase - maintain." (2:1-1) We must combine the skills of the acquisition project manager with the knowledge and experience of the maintainer to enhance our ability to command and control the battlefield.

PEACETIME TO WARTIME TRANSITION

The final leg of the maintenance triangle is the peacetime to wartime transition of the maintenance effort. How well the Marine Corps transitions from maintenance in a garrison environment to wartime conditions is a critical function which provides commanders command and control capability during a conflict. The Marine Corps' expeditionary nature demands that we establish transition procedures and train in peacetime as we will fight in war.

Sound transition procedures will ensure the success of our maintenance support.

The Marine Corps' maintenance concept is to provide support as far forward on the battlefield as possible. This concept provides rapid, responsive repair of equipment in close proximity to the using units. The result is improved service for command and control systems.

The Marine Corps' maintenance forward concept provided significant advantages over the Army's maintenance capability during Operations Desert Shield and Desert Storm. The Army repaired most of its equipment at large maintenance facilities located in rear areas. Whole components, known as lowest repairable units (LRUs), in need of repair would be sent to these Direct Exchange (DX) facilities where the LRU would be replaced out of a stockpile of like components. The Army does attempt to repair as much equipment forward as possible. However, Army technicians lack sufficiently diverse training on various components, making it difficult for them to support different systems. Additionally, the Army's larger funding and ability to stockpile spares makes the direct exchange of LRUs possible.

During Desert Storm, Army DX facilities were often more than 300 miles from their users, which caused lengthy delays in returning equipment to forward units. When the

number of LRUs in need of repair exceeded the quantity of serviceable components held in the DX facility's stockpile, Army maintenance suffered. The Marine Corps' maintenance forward concept, on the other hand, provided a higher echelon of maintenance capability forward, making the system more responsive. (3)

MAINTENANCE FORWARD CONCEPT

Success of the maintenance forward concept is determined by established transition procedures and peacetime training. Peacetime training, accomplished during field exercises and simulated operations, tests only part of our maintenance system. Daily maintenance routines, consisting of actual equipment repair and administrative procedures, are practiced in a tactical environment the same way they are conducted in garrison. This practice alleviates some of the confusion that accompanies the transition to a real conflict; however, it does not thoroughly test other critical factors of the maintenance system which support the maintenance forward transition. These critical factors include employing CLD float blocks, employing maintenance contact teams, identifying supply support, transporting and lifting assets, identifying automated reporting requirements, and maintaining civilian contracted end items. Although these

factors can be tested to a limited degree during a field training exercise, they cannot be fully put to the test until they are employed during a conflict. Establishing sound procedures for their employment during a conflict and correcting past mistakes will enhance the effectiveness of the maintenance system.

Overall, the Marine Corps' maintenance forward concept during Operations Desert Shield and Desert Storm was successful. The quality of the technician training contributed to the success, as did the Marine Corps' employment of maintenance kits and CLD float blocks. Spare parts to repair CLD equipment were available at the intermediate maintenance level, without having to wait for shipments from logistics facilities in the States. Repair of the AN/PSC-3 single channel satellite communications radio is a primary example. Because the Marine Corps' communication battalions deployed with repair parts for CLD items, the PSC-3s in country, including those belonging to the Army, were repaired quickly, reducing down time of the radio nets they provided. (7)

MAINTENANCE CONTACT TEAMS

Maintenance contact teams also added to the success of the maintenance forward concept. Contact teams, equipped with the necessary spare parts and test equipment from rear

units, were sent to remote areas throughout the desert to repair downed equipment. The communication battalions in particular provided extensive maintenance contact team support to their detachments located with the forward units. Although providing personnel for contact teams taxed the rear unit's maintenance effort by dedicating personnel for on-call repairs, our research indicates the contact teams' contributions to the overall maintenance effort were invaluable. (5)

The Marine Corps maintenance system's transition to war was effective, but it was not without shortcomings. One major weakness was the lack of spare parts available in country. When CLD float blocks were exhausted, or when normal low density equipment was in need of repair, adequate secondary repairables were not on hand, which resulted in untimely maintenance support. Units were forced to perform selective interchange, and sometimes controlled cannibalization, of the required parts, or to delay equipment repair until parts became available. (15,17)

AUTOMATED INFORMATION SYSTEM SUPPORT

Another shortcoming of the maintenance system's transition to the field was the piecemeal employment of the Supported Activities Supply System (SASSY) and Marine Corps

Integrated Maintenance Management System (MIMMS) Automated Information Systems (AIS) at the start of the war. Full implementation of these systems was delayed for two reasons. First, the daily volume of processing support required for MIMMS and SASSY transactions was underestimated during the planning phase of the operation. The Information Systems Management Officer (ISMO) and the functional managers of supply and maintenance did not anticipate the large support requirements that surfaced within the first few months. Once the Marine Expeditionary Force (MEF) was fully established in country, the volume of SASSY and MIMMS transactions increased dramatically. The limited processing capability of the Intermediate Force Automated Service Center (IFASC), which was initially deployed to meet AIS requirements, was not adequate to meet the high volume of daily processing transactions. It was not until the Deployed Regional Automated Service Center (DRASC) was deployed to the theater of operations that the problem was finally solved. The DRASC provided sufficient mainframe processing support to meet the MEF's requirements.

Second, the dedicated data communication link required for connectivity between the DRASC and the supporting Regional Automated Service Center (RASC) in Okinawa, Japan, was not established in time to meet the processing

requirements of the MEF. This link was essential for the high speed data transfer over the Marine Corps Data Network (MCDN) which provides SASSY and MIMMS support. Installation of other command and control communication links held a higher priority and were responsible for delaying the dedicated data communication link. Eventually this data link was provided when an AN/TSC-93A satellite communication path was established. (8)

TRANSPORTATION SHORTFALLS

The lack of transportation and lift assets available to support the maintenance effort was another shortcoming. Dedicated transportation was not available for moving maintenance shelters, repair parts, and repaired equipment to forward units. For example, forward units often had to drive one hundred miles or more to retrieve priority equipment that was repaired at the major maintenance facilities at ELMACO at the Port of Al Jubayl. (9) Movement of maintenance shelters provided another transportation problem. The dragon wagon (LVS) was the only asset capable of transporting the large shelters, but higher logistical priorities - providing beans, bullets and bandaids - limited their availability. Host Nation Support (HNS) and British motor transport assets eventually transported many of these shelters. (13)

TACTICAL COMPUTER MAINTENANCE

Another shortcoming was the dependence on civilian contractors for equipment maintenance. The AN/UYK-83 and AN/UYK-85 tactical computers were purchased with civilian contracted maintenance. Marine Corps maintenance facilities held limited assets to float monitors and printers for these systems. However, when the central processing units required repair, they had to be evacuated to the States for civilian maintenance. (10) The reduced response time for recovering these units degraded the effectiveness of the vital Local and Wide Area Networks (LAN/WAN) which they supported.

CORRECTING TRANSITION PROBLEMS

Providing maintenance as far forward as possible is necessary for command and control support in a combat environment. Correcting transition problems will enhance the Marine Corps' ability to provide this support. Supply and maintenance units must coordinate what repair parts should deploy with units in the floats and maintenance kits. This coordination will alleviate the spare parts deficiencies for repairs once units arrive in country and prevent resorting to selective interchange or cannibalization to repair equipment quickly. ISMOs and functional managers of SASSY and MIMMS must correctly

estimate the daily volume of transactions in order to predict mainframe processing requirements. Identifying maintenance requirements to the ISMO in the States must be accomplished as early as possible. Prior to deploying, using units must identify transportation requirements for maintenance shelters and repaired equipment to the FSSG's Motor Transport Battalion. Establishing transportation priorities and dedicating assets early on will prevent heavy reliance on HNS or allied assets. Finally, technicians must be trained to repair all tactical and off-the-shelf equipment to prevent dependence on civilian contractors. Fast paced operations cannot be degraded because technicians are not authorized or trained to repair equipment in country.

CONCLUSION

The Marine Corps' maintenance system is effective, but measures can be taken to improve the system. By analyzing each leg of the communication-electronic maintenance triangle, we have identified measures by which the system can be strengthened. The Marine Corps produces well trained technicians, but must implement the outlined training recommendations to maximize the investment dollars required to train technicians. Restructuring the equipment acquisition process will ensure maintenance concepts are

developed to support and sustain procured systems. Finally, thorough planning for maintenance concerns prior to deployment will strengthen the maintenance forward concept. Training, acquisition, and the transition from peacetime to wartime are absolutely critical to promote a virtually flawless maintenance system. These maintenance foundations, when integrated with the communication--electronic maintenance triangle, support the command and control of our forces during a conflict. Only by implementing these recommendations will the Marine Corps continue to have an effective and responsive maintenance system.

APPENDIX 1

SAMPLE QUESTIONNAIRE

Input for this research was obtained from information received in response to the following questionnaire. Responses were given under a non-attribution policy; therefore, no names are associated with the information.

Questionnaires were distributed to 26 Marines. Twenty-one responses were received from staff non commissioned officers, warrant officers, limited duty officers, company grade officers, and field grade officers. Experience with the Marine Corps maintenance system ranged from ten to more than 25 years. Ninety percent of the responses came from maintenance LDOs, field grade maintenance officers, and field grade communication officers. All had extensive communication-electronic maintenance experience in the FMF and MCCDC, Quantico. Each respondent agreed that the Marine Corps maintenance system was not broken but offered insight into areas which could be improved.

APPENDIX 1

MARINE CORPS MAINTENANCE SYSTEM QUESTIONNAIRE

Note: Please highlight any areas you would like to see emphasized in our research paper.

1. What problems do you see in the Marine Corps maintenance system for comm-elect and motor transport, specifically personnel/training, equipment, and supply?

2. How (if at all) does the acquisition process hinder the maintenance system? What causes these problems? How could they be solved?

3. What were the strengths and weaknesses of the maintenance system during Operations Desert Shield and Desert Storm? How did acquisition play a role as a strength or weakness?

4. Does the maintenance system efficiently and effectively transition from garrison functions to wartime and exercise operations? If so, how? If not, why?

5. Should the stockpiling of significant quantities of spare parts to expand PEB items be authorized within units? Would this assist in repairing equipment in a more timely manner? If so, how? If not, why?

6. Do you think the standard maintenance reporting procedures (LM2 reports and DPRs) are accurate and useful for commanders?
If not, how would you make them so? Is there a better alternative?

7. Are the Prepositioned Wartime Reserves (PWR) and the float systems effective and efficient? If not, how could we make them more so?

8. Is the Marine Corps maintenance system broken in any aspect?
Yes or No? How? Why? Recommended solutions?

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17. Personal Interview Number 6, Lieutenant Colonel, USMC, Maintenance Officer, MARCORSYSCOM, 24 November 1992.

18. Personal Interview Number 7, Lieutenant Colonel, USMC, Maintenance Officer, MARCORSYSCOM, 3 December 1992.

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28. Questionnaire Number 9, First Lieutenant, USMC, Maintenance Officer, ELMACO, 23 November 1992.

29. Questionnaire Number 10, First Lieutenant, USMC, Maintenance Officer, MCCDC, 22 November 1992.

30. Questionnaire Number 11, Staff Sergeant, USMC, Maintenance Chief, 19 November 1992.

31. Questionnaire Number 12, Captain, USMC, Maintenance Officer, 7 December 1992.

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